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SOLAR ECLIPSES, 1968 - 1970

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At the request of Commission 12a of the International Astronomical Union, the office of the American Ephemeris agreed to publish advance information on solar eclipses, computed from tabular positions of the Sun and Moon prepared for the purpose in the British Nautical Almanac Office. The data concerning all solar eclipses from 1960 to 1967 inclusive have been published in *U. S. Naval Observatory Circulars* Nos. 59 and 85.

The present circular gives the results of a preliminary calculation for all solar eclipses in 1968, 1969 and 1970.

In conformity with the adoption of Ephemeris Time in the national ephemerides, beginning in 1960, the arguments are given here in Ephemeris Time (E.T.), and the longitudes are referred to the "Ephemeris meridian" as defined by D. H. Sadler, *Occasional Notes of the R. A. S.*, No. 17, vol. 3, 1954.

Once the value of ΔT is known, the accurate position of the track may be obtained very simply, and without interpolation, in the following manner:

Change all time-arguments into Universal Time by setting

$$UT = E.T. - \Delta T$$

Leave latitudes unchanged, and refer the longitudes to the meridian of Greenwich by applying $-1.0027 \Delta T$ as a correction to the tabulated longitudes, remembering that a second of time is equivalent to 15 seconds of arc.

The value of ΔT can be accurately determined only in arrear. Past experience shows that a value estimated five years in advance may be in error by amounts up to 5 seconds. A predicted value, applicable to all data in this *Circular*, is +38 seconds of time.

PARTIAL ECLIPSE OF 1968 MARCH 28-29

In the eclipse of 1968 March 28-29, geocentric conjunction will occur in right ascension $0^{\text{h}}30^{\text{m}}25^{\text{s}}.04$, at E.T. $28^{\text{d}}21^{\text{h}}53^{\text{m}}54^{\text{s}}.3$, the declination of the Sun being $+3^{\circ}17'04''.4$. The greatest eclipse will have the magnitude 0.899, at longitude $+79^{\circ}55'$, latitude $-61^{\circ}09'$.

The eclipse will be observable in parts of Antarctica, the South Pacific Ocean and the southern part of South America.

TOTAL ECLIPSE OF 1968 SEPTEMBER 22

Central Line

Ephemeris Time	Latitude	Ephemeris Longitude	Duration on Central Line	Width of Path
h m	° '	° '	m s	mi
Limit	+79 35	-108 09	. . . .	...
10 45	78 58.1	91 52.2	0 18.2	33
50	73 37.9	68 43.7	0 27.0	44
55	69 35.0	64 01.8	0 31.6	49
11 00	+66 10.7	- 62 27.9	0 34.7	53
05	63 10.5	62 06.6	0 37.0	56
10	60 27.0	62 23.4	0 38.5	59
15	57 56.0	63 04.7	0 39.4	63
20	55 34.7	64 04.9	0 39.7	65
25	53 21.2	65 22.5	0.39.4	67
11 30	+51 14.1	- 66 58.3	0 38.6	68
35	49 12.5	68 56.3	0 37.0	68
40	47 15.5	71 24.1	0 34.7	67
45	45 22.4	74 39.6	0 31.4	62
50	43 32.5	79 36.9	0 26.1	52
Limit	+42 15	- 89 57	. . . .	...

In the eclipse of 1968 September 22, geocentric conjunction will occur in right ascension $11^{\text{h}}58^{\text{m}}02^{\text{s}}.49$, at E.T. $22^{\text{d}}10^{\text{h}}22^{\text{m}}08^{\text{s}}.4$, the declination of the Sun being $+0^{\circ}12'44''.9$.

ANNULAR ECLIPSE OF 1969 MARCH 18

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
	° ' "	° ' "	m s	mi
Limit	-45 00	- 43 42	. . . .	...
3 10	44 54.4	52 42.5	1 08.8	41
15	43 25.8	67 41.0	1 01.3	33
20	41 51.7	75 26.7	0 56.6	29
25	40 17.5	81 03.0	0 52.7	25
3 30	-38 44.2	- 85 28.9	0 49.3	23
35	37 12.0	89 09.0	0 46.2	21
40	35 41.0	92 16.7	0 43.4	19
45	34 11.2	94 59.9	0 40.9	17
50	32 42.5	97 24.2	0 38.6	17
55	31 15.0	99 33.3	0 36.4	15
4 00	-29 48.4	-101 30.0	0 34.5	14
05	28 22.9	103 16.6	0 32.8	13
10	26 58.2	104 54.8	0 31.3	13
15	25 34.3	106 25.9	0 30.0	12
20	24 11.2	107 51.1	0 28.8	11
25	22 48.8	109 11.3	0 27.8	11
4 30	-21 27.1	-110 27.4	0 27.0	10
35	20 05.9	111 40.2	0 26.4	10
40	18 45.3	112 50.2	0 26.0	10
45	17 25.2	113 58.0	0 25.8	10
50	16 05.4	115 04.2	0 25.7	10
55	14 46.1	116 09.3	0 25.8	10
5 00	-13 27.1	-117 13.7	0 26.1	10
05	12 08.4	118 18.0	0 26.5	10
10	10 49.9	119 22.5	0 27.2	11
15	9 31.6	120 27.8	0 28.0	11
20	8 13.5	121 34.4	0 29.0	12
25	6 55.4	122 42.8	0 30.1	13
5 30	- 5 37.5	-123 53.6	0 31.5	13
35	- 4 19.5	-125 07.3	0 33.0	14

ANNULAR ECLIPSE OF 1969 MARCH 18 (Continued)

h m	° '	° '	m s	mi
5 40	- 3 01.6	-126 24.8	0 34.6	15
45	1 43.5	127 46.8	0 36.5	16
50	- 0 25.3	129 14.3	0 38.5	17
55	+ 0 53.1	130 48.6	0 40.7	19
6 00	+ 2 11.8	-132 31.0	0 43.1	20
05	3 30.7	134 23.6	0 45.7	21
10	4 50.1	136 29.0	0 48.5	24
15	6 10.1	138 50.7	0 51.5	25
20	7 30.6	141 34.4	0 54.7	28
25	8 52.1	144 48.9	0 58.3	30
6 30	+10 14.8	-148 51.3	1 02.3	33
35	11 39.4	154 22.5	1 07.1	38
40	13 09.9	164 53.2	1 14.3	44
Limit	+13 30	-171 37	. . . .	...

In the eclipse of 1969 March 18, geocentric conjunction will occur in right ascension $23^{\text{h}}50^{\text{m}}29^{\text{s}}.82$, at E.T. $18^{\text{d}}04^{\text{h}}38^{\text{m}}22^{\text{s}}.6$, the declination of the Sun being $-1^{\circ}01'48''.2$.

ANNULAR ECLIPSE OF 1969 SEPTEMBER 11

Central Line

Ephemeris Time	Latitude	Ephemeris Longitude	Duration on Central Line	Width of Path
h m	° '	° '	m s	mi
Limit	+41 32	-173 22	. . . .	...
18 10	41 56.1	+170 54.6	3 06.1	101
15	41 10.6	160 43.9	3 08.7	94
20	40 09.1	154 07.9	3 10.4	90
25	39 01.3	149 04.9	3 11.7	87
18 30	+37 50.4	+144 57.7	3 12.6	85
35	36 37.5	141 28.8	3 13.3	82
40	35 23.5	138 28.2	3 13.8	81
45	+34 08.8	+135 49.4	3 14.2	79

ANNULAR ECLIPSE OF 1969 SEPTEMBER 11 (Continued)

h	m	°	'	°	'	m	s	mi
18	50	+32	53.7	+133	27.9	3	14.4	78
	55		31 38.3		131 20.7	3	14.5	77
19	00	+30	22.9	+129	25.2	3	14.6	75
	05		29 07.4		127 39.5	3	14.5	75
	10		27 51.9		126 02.2	3	14.4	74
	15		26 36.4		124 31.9	3	14.2	73
	20		25 21.0		123 07.7	3	13.9	72
	25		24 05.7		121 48.6	3	13.6	72
19	30	+22	50.5	+120	34.0	3	13.3	71
	35		21 35.3		119 23.0	3	13.0	71
	40		20 20.1		118 15.2	3	12.6	71
	45		19 04.9		117 10.0	3	12.2	71
	50		17 49.8		116 06.9	3	11.8	71
	55		16 34.6		115 05.4	3	11.4	71
20	00	+15	19.3	+114	05.2	3	11.1	71
	05		14 04.0		113 05.7	3	10.7	71
	10		12 48.5		112 06.6	3	10.3	71
	15		11 32.8		111 07.4	3	10.0	71
	20		10 16.9		110 07.9	3	09.7	72
	25		9 00.8		109 07.4	3	09.4	73
20	30	+ 7	44.4	+108	05.6	3	09.0	74
	35		6 27.6		107 02.0	3	08.7	75
	40		5 10.4		105 56.0	3	08.4	75
	45		3 52.6		104 47.1	3	08.1	76
	50		2 34.4		103 34.6	3	07.8	78
	55	+ 1	15.4		102 17.6	3	07.5	78
21	00	- 0	04.3	+100	55.1	3	07.2	80
	05		1 24.8		99 26.2	3	06.8	82
	10		2 46.4		97 49.2	3	06.4	82
	15		4 09.3		96 02.2	3	06.0	84
	20		5 33.5		94 02.7	3	05.5	86
	25		6 59.6		91 47.1	3	04.9	88
21	30	- 8	28.0	+ 89	09.8	3	04.3	90
	35		9 59.4		86 01.8	3	03.5	92
	40		11 35.3		82 06.0	3	02.5	94
	45		13 19.0		76 40.8	3	01.1	97
	50	-15	28.2	+ 66	02.1	2	58.6	104

ANNULAR ECLIPSE OF 1969 SEPTEMBER 11 (Continued)

	° ' "	° ' "	m s	mi
Limit	-16 08	+ 59 49	. . . .	...

In the eclipse of 1969 September 11, geocentric conjunction will occur in right ascension $11^{\text{h}}19^{\text{m}}07^{\text{s}}.08$, at E.T. $11^{\text{d}}19^{\text{h}}45^{\text{m}}06^{\text{s}}.1$, the declination of the Sun being $+4^{\circ}24'01''.6$.

TOTAL ECLIPSE OF 1970 MARCH 7

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° ' "	° ' "	m s	mi
Limit	- 2 00	+148 42	. . . .	...
16 10	2 13.8	133 25.0	1 57.1	73
15	1 31.6	127 30.0	2 11.5	79
20	- 0 39.4	123 15.0	2 23.0	84
25	+ 0 18.2	119 50.9	2 32.6	87
16 30	+ 1 19.3	+116 58.8	2 41.1	90
35	2 23.2	114 29.0	2 48.6	93
40	3 29.1	112 15.8	2 55.2	94
45	4 36.9	110 15.5	3 01.1	96
50	5 46.3	108 25.3	3 06.4	97
55	6 57.2	106 43.3	3 11.0	97
17 00	+ 8 09.4	+105 07.9	3 15.0	98
05	9 22.9	103 37.9	3 18.4	98
10	10 37.8	102 12.3	3 21.3	98
15	11 53.9	100 50.2	3 23.6	98
20	13 11.2	99 30.8	3 25.4	97
25	14 29.9	98 13.5	3 26.7	97
17 30	+15 49.9	+ 96 57.5	3 27.5	97
35	17 11.3	95 42.3	3 27.7	96
40	18 34.1	94 27.3	3 27.5	95
45	19 58.5	93 11.7	3 26.8	94
50	21 24.5	91 55.1	3 25.7	94
55	+22 52.2	+ 90 36.7	3 24.0	93

TOTAL ECLIPSE OF 1970 MARCH 7 (Continued)

h m	° '	° '	m s	mi
18 00	+24 21.8	+ 89 15.7	3 21.9	91
05	25 53.5	87 51.4	3 19.2	90
10	27 27.3	86 22.8	3 16.1	90
15	29 03.6	84 48.6	3 12.5	88
20	30 42.6	83 07.7	3 08.4	87
25	32 24.7	81 18.2	3 03.7	86
18 30	+34 10.2	+ 79 18.1	2 58.5	84
35	35 59.6	77 04.4	2 52.7	82
40	37 53.6	74 33.4	2 46.3	81
45	39 53.2	71 39.6	2 39.2	79
50	41 59.5	68 14.6	2 31.2	78
55	44 14.4	64 04.6	2 22.1	75
19 00	+46 41.2	+ 58 44.1	2 11.6	72
05	49 26.6	51 13.7	1 58.8	69
10	52 55.9	37 26.3	1 39.9	63
Limit	+55 01	+ 22 36	. . . .	...

In the eclipse of 1970 March 7, geocentric conjunction will occur in right ascension $23^{\text{h}}11^{\text{m}}15^{\text{s}}.52$, at E.T. $7^{\text{d}}18^{\text{h}}03^{\text{m}}50^{\text{s}}.8$, the declination of the Sun being $-5^{\circ}13'49''.0$.

ANNULAR ECLIPSE OF 1970 AUGUST 31 - SEPTEMBER 1

Ephemeris Time	Central Line		Duration on Central Line	Width of Path
	Latitude	Ephemeris Longitude		
h m	° '	° '	m s	mi
Limit	- 4 47	-146 58	. . . .	...
20 20	3 38.1	160 38.7	5 40.8	189
25	3 49.9	165 59.1	5 52.5	189
20 30	- 4 16.8	-169 47.8	6 01.7	188
35	4 51.6	172 50.2	6 09.3	188
40	5 31.7	175 23.6	6 15.9	187
45	6 15.7	177 36.6	6 21.7	186
50	7 02.8	-179 34.4	6 26.7	185
55	7 52.6	+178 39.6	6 31.1	184
21 00	- 8 44.7	+177 02.9	6 34.8	183

ANNULAR ECLIPSE OF 1970 AUGUST 31 - SEPTEMBER 1 (Continued)

h	m	°	'	°	'	m	s	mi
21	05	- 9	38.8	+175	33.9	6	38.1	181
	10	10	34.7	174	11.3	6	40.8	179
	15	11	32.4	172	53.8	6	43.1	177
	20	12	31.7	171	40.6	6	44.9	175
	25	13	32.7	170	31.1	6	46.4	173
21	30	-14	35.2	+169	24.5	6	47.4	170
	35	15	39.2	168	20.3	6	48.1	168
	40	16	44.8	167	17.9	6	48.5	166
	45	17	51.9	166	16.9	6	48.4	164
	50	19	00.6	165	16.8	6	48.2	162
	55	20	10.9	164	17.2	6	47.6	161
22	00	-21	23.0	+163	17.6	6	46.7	159
	05	22	36.7	162	17.6	6	45.6	158
	10	23	52.4	161	16.6	6	44.2	156
	15	25	10.0	160	14.2	6	42.5	155
	20	26	29.7	159	09.8	6	40.6	155
	25	27	51.7	158	02.8	6	38.5	154
22	30	-29	16.1	+156	52.3	6	36.1	154
	35	30	43.2	155	37.7	6	33.5	154
	40	32	13.3	154	17.9	6	30.6	154
	45	33	46.7	152	51.6	6	27.5	154
	50	35	23.8	151	17.2	6	24.0	155
	55	37	05.2	149	32.9	6	20.2	155
23	00	-38	51.6	+147	35.7	6	16.1	156
	05	40	43.8	145	22.1	6	11.6	158
	10	42	43.3	142	46.5	6	06.6	159
	15	44	51.9	139	40.5	6	01.0	162
	20	47	12.7	135	49.6	5	54.7	165
	25	49	51.4	130	45.3	5	47.2	169
23	30	-53	01.5	+123	14.6	5	37.8	174
	35	58	04.2	105	06.1	5	20.6	188
Limit		-59	16	+ 98	22	. . . .		...

In the eclipse of 1970 August 31 - September 1, geocentric conjunction will occur in right ascension $10^{\text{h}}38^{\text{m}}58^{\text{s}}.17$, at E.T. $31^{\text{d}}22^{\text{h}}28^{\text{m}}50^{\text{s}}.5$, the declination of the Sun being $+8^{\circ}32'22''.7$.